BOVA Network - Building Out Vector-borne diseases in sub-Saharan Africa

First BOVA Open Network Meeting
IEDE-UCL, London, 28th March 2018
Designers and builders of both traditional and contemporary houses rarely consider the problem of domestic and peridomestic insect pests unless, like ants and termites, they directly threaten the structural integrity of the building (BRE, 1976). Yet many arthropods have achieved medical importance through association with man and his domestic environment, and most vector-borne human diseases are, or can be, transmitted in the home (Table I). Most medically important arthropods are blood-suckers including ease of construction and absorption of spilt liquids. Floors of wooden planks have other advantages but the space below them, if unsealed, can provide convenient sites for arthropods and other vermin. Cracked and uneven mud floors may provide refuges for flea larvae, house-dust mites (Dermatophagoides spp.) and soft Argasid ticks of the Ornithodoros type, especially under sleeping mats (Fig. 1a). *Triatoma dimidiata*, an important vector of Chagas’ disease in central America also occurs commonly under
What is the BOVA Network?

• Interdisciplinary network of researchers and practitioners working on insect-borne diseases and the built environment
• Aims to establish a new research discipline
Principal Pillars of Public Health

- Clean water
- Sanitation
- Housing
BOVA Network activities

- Pump-prime funding
- Global advocacy
- Yearly open network meetings for information exchange
- Grant writing workshops
Who are we?

Network directors

Prof. Steve Lindsay
Durham University

Prof. Mike Davies
IEDE, UCL

Network Management Board (architects, social scientists, economists, policy makers, urban planners, development practitioners, product developers AND entomologists/epidemiologists)
BOVA Conceptual Framework

Goal
Sustainable & resilient communities free of insect-borne diseases

Objectives
Develop and scale-up products & approaches in the built environment for preventing disease

Action
- Information exchange
- Basic and applied research
- Capacity building
- Advocacy and sustainability

Foundation
Network of experts in insect-borne diseases and the built environment

Management Board
What is the burden of insect-borne diseases?
Insect-borne diseases – a major cause of ill health and death in Africa

Combined global distribution of *falciparum* and *vivax* malaria, lymphatic filariasis, dengue, onchocerciasis, cutaneous and visceral leishmaniasis, human African trypanosomiasis and yellow fever

Source: WHO 2016, Golding et al 2015
Malaria

• 216 million malaria cases and 445,000 deaths in Africa in 2016
• Africa accounted for 90% of malaria cases and 91% of malaria deaths in 2016
Diseases carried by *Aedes* mosquitoes

- Dengue is world’s fastest growing insect-borne disease.
- Estimated 96 million dengue cases in 2010
- Global epidemic of Zika
- Yellow fever outbreaks in Africa
Outbreaks in the media

Angola's yellow fever outbreak could become 'global emergency'

19 May 2016

Burkina: 4,017 cas suspects de dengue, 11 décès

28 October 2017 A 14h01

Yellow Fever Circles Brazil's Huge Cities

Global Health

The Times of India

Dengue Cases On The Rise

Dengue Vaccine Still Far Away
Overlap between *Aedes* mosquito and human populations

- Cities >1M inhabitants
- Predicted *Aedes aegypti* distribution in 2015

Nick Golding, unpublished
What control methods do we currently have?

- Insecticide-treated bednets
- Fogging
- Indoor-residual spraying
- Larval source management
Declines in malaria attributable largely to mosquito control
Insecticide resistance

Killing of malaria mosquitoes when exposed to two different types of insecticide (deltamethrin (blue) or permethrin (orange)).

Source: Ranson and Lissenden 2016
What is the link between insect-borne diseases & the built environment?
Link between insect-borne diseases & the built environment

- Poorly screened houses
- Open water containers
- Polluted still water
- Solid waste accumulation
Why the built environment?

• Determinants of vector-borne diseases lie outside the health sector
• GVCR calls for multi-sectoral response
• Need to expand the vector control toolbox
What’s the evidence for improvement of the built environment on the reduction of vector-borne diseases?
Housing improvements - evidence

- 80-100% of malaria infections occurs indoors at night
- Children living in improved housing had about half the odds of having a malaria infection compared to those living in traditional housing.
- Protection provided by good housing may be similar to insecticide-treated bednets against malaria.
- House screening can reduce dengue incidence by about three quarters.

Introduction

New tools and approaches are required to achieve the ambitious targets outlined in the WHO Global Technical Strategy for Malaria 2016-2030 (GTS) and the complementary Roll Back Malaria (RBM) global framework for Action and Investment to Defeat Malaria 2016-2030 (AIM) of at least a 90% reduction in malaria mortality and case incidence, and elimination from 35 countries by 2030, while preventing re-introduction into malaria-free areas. Additional interventions are needed to compliment the current tools which rely heavily on effective insecticides for optimal protection. There is a need to look beyond long-lasting insecticidal nets (LLINs) and indoor residual spraying (IRS), particularly to address the challenges of insecticide resistance and transmission that occurs at places and times when populations are not adequately protected by these two core interventions.

The value of a multi-sector developmental approach that couples current interventions with complementary strategies addressing key social and environmental determinants of malaria has been recognised by RBM and the United Nations Development Programme. The AIM framework cited above, notes the potential contribution of the housing sector to malaria control and elimination. AIM also considers the relation
Environmental management - malaria

- Immature stages of malaria mosquitoes occur in a wide range of waterbodies, but rarely containers.
- Drainage & filling of aquatic habitats will contribute to a reduction in adult mosquitoes.
Environmental management – Aedes-borne diseases

- Immature stages of *Aedes* occur in water-storage containers, used tyres, solid waste etc.
- Provision of reliable piped water, removal of tyres, waste management etc will reducing the number of adult mosquitoes.
- Community-based environmental management shown to reduce *Aedes* mosquitoes and dengue infection.
Links with other global policies
Summary

• Vector-borne diseases are a major threat to the health of citizens living in the tropics & sub-tropics
• Modifying the built environment is a supplementary measure for reducing this risk
• This can only be achieved if experts in vector-borne diseases work hand-in-hand with those in the built environment
• There has never been a better time to do this.
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#buildoutvectors

www.bovanetwork.org
Acknowledgments: